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document T.OkudaSuper-Eddington Black-Hole Models for SS 433

Super-Eddington Black-Hole Models for SS 433

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abstract

We examine highly super-Eddington black-hole models for SS 433, based on two-dimensional hydrodynamical calculations coupled with radiation transport. The super-Eddington accretion flow with a small viscosity parameter, $\alpha = 10^{-3}$, results in a geometrically and optically thick disk with a large opening angle of $\sim 60^\circ$ to the equatorial plane and a very rarefied, hot, and optically thin high-velocity jets region around the disk. The thick accretion flow consists of two different zones: an inner advection-dominated zone and an outer convection-dominated zone. The high-velocity region around the disk is divided into two characteristic regions, a very rarefied funnel region along the rotational axis and a moderately rarefied high-velocity region outside of the disk. The temperatures of $\sim 10^7$ K and the densities of $\sim 10^{-7}$ g cm^{-3} in the upper disk vary sharply to $\sim 10^8$ K and 10^{-8} g cm^{-3}, respectively, across the disk boundary between the disk and the high-velocity region. The X-ray emission of iron lines would be generated only in a confined region between the funnel wall and the photospheric disk boundary, where flows are accelerated to relativistic velocities of $\sim 0.2\ c$ due to the dominant radiation-pressure force. The results are discussed regarding the collimation angle of the jets, the large mass-outflow rate obserevd in SS 433, and the ADAFs and the CDAFs models.